

HAER  
IOWA  
32-DOLL.V,  
1-

HAER No. IA-52

ELLSWORTH RANCH BRIDGE  
(Des Moines River Bridge)  
Iowa Bridges Recording Project  
Spanning East Fork of Des Moines River  
at 130th Street  
Dolliver Vicinity  
Emmet County  
Iowa

BLACK & WHITE PHOTOGRAPHS

WRITTEN HISTORICAL & DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD  
National Park Service  
Department of the Interior  
P.O. Box 37127  
Washington, D.C. 20013-7127

HISTORIC AMERICAN ENGINEERING RECORD

ELLSWORTH RANCH BRIDGE  
(Des Moines River Bridge)

HAER  
IOWA  
32-DOLL.V,  
1-

HAER No. IA-52

Location: Spanning the East Fork of the Des Moines River at 130th Street; 1.5 miles east of Dolliver; Emmet County, Iowa  
UTM: 15.372160.4812885  
USGS: Dolliver, Iowa quadrangle (7.5 minute series, 1980)

Date of Construction: 1895

Fabricator: King Bridge Company, Cleveland, Ohio

Designer: Milo A. Adams, agent for King Bridge Company, Minneapolis, Minnesota

Contractor: King Bridge Company, Cleveland, Ohio

Present Owner: Emmet County, Iowa

Present Use: Roadway bridge

Significance: The Ellsworth Ranch Bridge represents an unusual variation of a Pratt truss. It is identical to two trusses found in South Dakota and Minnesota, both built in the mid-1890s by Milo A. Adams, agent of the King Bridge Company. The only one of its type in Iowa, the Ellsworth Ranch Bridge is a rare surviving example of structural experimentation by one of the country's most prolific 19th-century bridge manufacturers.

Historian: Leslie Pitner, August 1995

Project Information: This document was prepared as a part of the Iowa Historic Bridges Recording Project performed during the summer of 1995 by the Historic American Engineering Record (HAER). The project was sponsored by the Iowa Department of Transportation (IDOT). Preliminary research was performed by Clayton B. Fraser of Fraserdesign, Loveland, Colorado.

## INTRODUCTION

Emmet County, located in northwest Iowa, is an area of rich black soil and natural wetlands, home to some of the richest farmland in the world. The Ellsworth Ranch Bridge sits within this landscape, surrounded by pasture and corn fields. A unique variation of the Warren truss, it is one of only three of this type known to remain in the United States. Built by the King Bridge Company of Cleveland, Ohio in 1895, this elegant pin-connected steel bridge is an example of structural experimentation by the local agent Milo A. Adams.

In January of 1895, the Emmet County Board of Supervisors received a petition for a bridge over the East Fork of the Des Moines River in Lincoln Township. Supervisor Fitzgerald was appointed to study the matter and report back in April. In April, the construction of the Ellsworth Ranch Bridge was approved, along with two other bridges, and competitive bids were to be submitted for their fabrication and erection. When all the proposals were submitted the following month, the board adopted the plans of the King Bridge Company as "the most suitable," but rejected all the bids as too high. After further discussion, the supervisors rewrote the specifications for the Ellsworth Ranch Bridge, reducing its length from 100 feet to 80 feet in the hope that the reduction of materials would result in a lower cost. This strategy was successful. By the day's end, the supervisors had awarded a contract to the King Bridge Company for the construction of three bridges, including this truss, for \$3,400, and the Ellsworth Ranch Bridge was completed later that year.<sup>1</sup>

## THE BRIDGE BUILDING INDUSTRY

In the late nineteenth century, metal truss bridges became more and more common. Stronger and more durable than timber bridges, wrought iron became the material of choice, which was superseded in the 1890s by steel. The business of providing these metal bridges fell to bridge fabrication companies and bridge contractors. Many of these contractors were local firms, but the bridge fabrication industry was dominated by a few large companies whose reach was nationwide. Companies such as the King Bridge Company created organizations focused on marketing and selling their bridges across the United States.

The King Iron Bridge Company, later the King Bridge Company, was founded by Zenas King in 1871. King had first worked as an agent, a key role in bridge companies, for the Moseley Bridge

---

<sup>1</sup>Emmet County Board of Supervisors Minutes, January 13, 1895 (Book 3, 17), April 2, 1895 (3, 38), and May 1, 1895 (3, 46).

Company in Cincinnati. King soon began to experiment with bridge designs, and in 1861, patented a tubular iron bowstring arch-truss. From his work with Moseley, King knew the importance of marketing through advertisements and promotional catalogs. To facilitate sales, King had a system of agents (or representatives) who acted for King Iron in local bridge biddings. This network was extensive, and by 1878, he had agents in Boston, Philadelphia, Des Moines, Cortland (New York), Bloomington, Kansas City, and San Antonio.<sup>2</sup> A contract to build a bridge was awarded through competitive bidding by contractors on specifications provided by the county or city desiring a bridge. The local government supervisors would then inspect the plans and choose the lowest bidder. Through its agents, the King Iron Bridge Company could participate in biddings throughout the country and became one of the great successes of the bridge building industry.

Working as an agent was a great stepping stone for a man into the bridge building industry. Milo Adams took advantage of this opportunity. Adams was an engineer who was King's agent for Minnesota, Montana, and North and South Dakota. While Emmet County technically would have been the territory of King's Iowa agent, James Marsh, the county bordered Minnesota and must have been cultivated by Adams.<sup>3</sup> Adams used his autonomy as agent to these western states to develop his own truss design, which was exceptionally light and economical in materials. This truss design does not appear in any of the records of the King Bridge Company in Ohio, and seems to have been an experimental effort by Adams.<sup>4</sup> The reduction of the length of the Ellsworth Ranch Bridge to 80' enabled Adams to provide his hybrid Pratt truss to Emmet County. The two other Adams' trusses found in South Dakota and Minnesota are this length. Adams must have designed the

---

<sup>2</sup>David A. Simmons, "Bridge Building on a National Scale: The King Iron Bridge and Manufacturing Company," IA: The Journal for the Society for Industrial Archaeology, 15:2: (1989), 23-33. Simmons' article is the most complete history of the King Iron Bridge Company.

<sup>3</sup>"A Good Bridge Man," Des Moines Saturday Review, February 11, 1893, 3.

<sup>4</sup>"Rare King Bridge trusses found in S.D., Minn.," SIA Newsletter 21:1 (Spring 1992), 3.

truss specifically for the greatest economy of materials for an 80' truss.<sup>5</sup>

#### THE DEVELOPMENT OF THE IRON TRUSS BRIDGE

While the timber truss bridge remained in use in America until the late 1800s, the development of the railroad brought the proliferation of the iron truss bridge. The first iron bridge in America was developed by Thomas Paine, the same revolutionary pamphleteer, in 1786. He made several models of his bridge, but it was never actually constructed. The first iron bridge constructed in America was in Brownsville, Pennsylvania, built in 1836. These first bridges used cast iron, a material which is excellent in compression, but is brittle with low tensile strength. The early patents were not based on scientific analysis, but on trial and error, often with disastrous consequences.

Thomas Pratt was the designer of one of the first trusses based on scientific analysis in America. Born in 1812, he studied engineering at Rensselaer Polytechnic Institute in Troy, New York. After graduation, he was hired by the United States Army Engineers to work on the construction of dry docks. After a few years, he began work as a bridge engineer for the railroad.<sup>6</sup> Pratt received a patent with his father on a truss in 1844. It had parallel chords or a polygonal upper chord, with the upper chord, diagonals, and end posts in compression, and the bottom chord and diagonals in tension.

Squire Whipple, however, remains the pivotal figure in the development of the iron truss bridge in the United States. Trained in engineering at Union College, where he received a bachelor's degree in 1830, he was the first American engineer to rationalize the analysis of iron trusses.<sup>7</sup> Whipple began his career as a surveyor, first for the Baltimore and Ohio Railroad, and later for the New York State Canal System. While working for the Canal System, he built his first cast-iron arch truss. On April 24, 1841, he obtained his first patent for a cast-iron bowstring arch-truss. In 1846, he designed a trapezoidal truss, known as a Whipple truss. It was a variation on the Pratt truss,

---

<sup>5</sup>Ibid.

<sup>6</sup>Carl W. Condit, American Building Art: The Nineteenth Century, New York: Oxford University Press, 1960, 109-10.

<sup>7</sup>Eric DeLony, "Surviving Cast- and Wrought-Iron Bridges in America," IA: The Journal of the Society for Industrial Archeology, 19:2, (1993), 28.

where the diagonals extend across two panels, adding stability for long spans. In 1847, Whipple published A Work on Bridge Building, a seminal book in the application of scientific methods to determine the stresses in truss members. His analysis became a major step in bridge technology.

Whipple also claimed to have independently built the first Warren truss in the United States. James Warren and Willoughby Monzani, two British engineers, patented the Warren truss in 1848. The Warren truss was unique in two ways: it has no verticals and the diagonals slope in opposite directions. In its form, the Warren truss draws most heavily on the strength of triangulation. It was also an economical truss type because the primary members were all of the same length, making them easier to roll and erect. Later versions of the Warren truss sometimes add verticals or a second set of diagonals. The Warren truss gained in popularity after 1860, particularly for railroad bridges. The first wrought-iron Warren truss was built in 1869, and steel Warren trusses appeared frequently by the turn of the century.<sup>8</sup>

Although the truss configuration designed by M.A. Adams appears as a type of Pratt and Warren truss hybrid, the structure is closely related to the Pratt type. The central panel, composed of diagonal compression members, behaves under load like a more traditional Pratt truss that contains a vertical compression member. This v-shape panel is somewhat unusual and would be an efficient configuration for only short spans. Likely as a result of the extra expense required in connecting the v-shaped compression member with the lower chord as well as limited use for short spans, this hybrid Pratt through truss was not widely used.<sup>9</sup> The Ellsworth Ranch Bridge consists of five 16' panels for an 80' span, it has two verticals and four diagonals. The inclined end posts and outer diagonals have the same length, 22', and the same angle. The middle panel is distinct, however, with its shorter (17') diagonals to form a smaller triangle.

The upper chord and inclined end posts consists of two channels oriented vertically with lacing between. The lower chords are two punched rectangular eyebars. The verticals in the end panels are two square eyebars. The outside panel diagonals are two punched rectangular eyebars, and the inside panel diagonals are two angles with batten plates. The light outside diagonals have a very low threshold for buckling under compression, and could

---

<sup>8</sup>Condit, 117-18.

<sup>9</sup>Geoffrey H. Goldberg, "Stardyne Analysis of Ellsworth Ranch Bridge," held in the field notes of this report.

buckle under a heavy load such as a truck.<sup>10</sup> The extreme lightness of the members shows Adams' focus on economy of materials. The bridge is supported on concrete filled steel cylinders.

#### EMMET COUNTY

The Ellsworth Ranch Bridge is located in the northeastern part of Emmet County in Lincoln Township. While Iowa became a state in 1846, Emmet County remained the territory of the Sioux Indians until 1851, when this area was deeded to the United States in treaty of the Traverse de Sioux.<sup>11</sup> The county was only lightly populated (105 in 1860) until the advent of the railroad. A railroad depot was established in Estherville, the county seat, in 1882, and with it, the population tripled from 1,550 in 1880 to 4,274 in 1890.<sup>12</sup>

Northwestern Iowa is one of the most fertile areas in the world. It is a young glacial plain, part of the Wisconsin plain, land which is flatter and poorly drained forming a natural wetlands area. When tilled and drained, however, the rich black soil is revealed. Known as chernozem in Russian, it is the same as the fertile soil of the Ukraine. This soil is the best for growing corn, which is the primary crop of this area.<sup>13</sup>

The Ellsworth Ranch Bridge takes its name from the large farm which surrounded it when it was built. The land was owned by Eugene Ellsworth, one of Iowa's most successful businessmen of the late nineteenth century. Ellsworth was never a resident of Emmet County, but instead owned the land as part of his vast real estate business and investments.

Eugene Ellsworth was born in Milwaukee, Wisconsin in 1848. When he was sixteen, his family moved to Iowa Falls, Hardin County, in central Iowa. He entered his father's livery business, but soon branched out into real estate as well. In 1872, he began selling land in Hardin and Franklin counties. From this beginning, his real estate enterprise expanded into the firm of Ellsworth and

---

<sup>10</sup>Ibid.

<sup>11</sup>History of Emmet County and Dickinson County, Iowa, Vol. I (Chicago: The Pioneer Publishing Company, 1917), 60.

<sup>12</sup>History of Emmet County, 234-5.

<sup>13</sup>Leland L. Sage, A History of Iowa, (Ames, Iowa: The Iowa State University Press, 1974), 7, 12-3.

Jones, which made real estate loans for land throughout Iowa and Minnesota. Ellsworth and Jones had offices in Boston, Chicago, Iowa Falls, and Crookston, Minnesota.<sup>14</sup>

Ellsworth's connection to Emmet County began in 1881 with the expansion of the Burlington, Cedar Rapids, and Northern railroad. The railroad wanted to extend its line through Iowa Falls northwest to Sioux Falls, South Dakota. Ellsworth became secretary of the Cedar Rapids, Iowa Falls and Northwestern Land and Town Lot Company, which was formed to sell lots in the towns along the railroad line, and to secure the right of way for the rail line. In 1881, he beat out three other railways trying to build lines on a small neck of land between Spirit Lake and Lake Okoboji in Dickinson County, next to Emmet. With this, the Burlington, Cedar Rapids, and Northern established a depot and roundhouse in Estherville for the line which extended to Sioux Falls.<sup>15</sup> While working for the railroad, Ellsworth must have acquired the land for the ranch, perhaps initially intending to sell it in his real estate business. The land, instead, was worked as a farm and ranch until his death in 1907. It remained part of his estate until 1910 when an auction was held to sell off the livestock and the property was sold or transferred.<sup>16</sup>

Ellsworth owned 3,712 acres, an enormous farm by the standards of the time. His property included four complete sections of 640 acres. Each township in Iowa is divided into 640 acre sections, and in Emmet County, most roads run along section lines. The Ellsworth Ranch Bridge is at the corner of sections 23, 24, 25, and 25, surrounded by land that was owned by Ellsworth.<sup>17</sup> The bridge served to connect conveniently these sections of his land, but would not have been used by anyone else except for perhaps one neighbor. It seems a tribute to Ellsworth's wealth and influence that the Ellsworth Ranch Bridge was even built by the county.

---

<sup>14</sup>Ira Alfred Nichols, Pioneer Days in Iowa Falls, (Fort Dodge, Iowa: Messenger Printing Co., 1944), 326-30.

<sup>15</sup>Nichols, 329-30.

<sup>16</sup>Photograph of auction sales bill, held at the Emmet County Historical Society, Estherville, Iowa.

<sup>17</sup>Emmet County Plat Book, 1899, held at the Emmet County Historical Society, Estherville, Iowa.



ELLSWORTH RANCH BRIDGE

HAER No. IA-52

(Page 8)

The Ellsworth Ranch Bridge is a rare example this kind of hybrid Pratt truss designed by Milo Adams, the agent for the King Bridge Company. Adam's light and elegant truss conserved both material and expense, and is particularly significant as it is one of only three of its type remaining. The bridge also stands as a remnant of Eugene Ellsworth's real estate empire and his influence at the end of the nineteenth century. Set in a beautiful rural setting of pasture and corn fields, it gives an almost pristine view back into that time.

SOURCES CONSULTED

"A Good Bridge Man," Des Moines Saturday Review, February 11, 1893, 3.

Condit, Carl W. American Building Art: The Nineteenth Century. New York: Oxford University Press, 1960.

DeLony, Eric. "Surviving Cast- and Wrought-Iron Bridges in America." IA: The Journal of the Society for Industrial Archeology. 19:2, (1993), 17-47.

Dolliver Photo Album, held at the Emmet County Historical Society.

Emmet County Board of Supervisors Minutes, Book 3, at Emmet County Courthouse, Estherville, IA.

Goldberg, Geoffrey H. "Stardyne Analysis of Ellsworth Ranch Bridge." held in the field notes of HAER report IA-52, "Ellsworth Ranch Bridge."

History of Emmet County and Dickinson County, Iowa. Vol. I. Chicago: The Pioneer Publishing Company, 1917.

Iowa Historic Bridge Inventory. Vol. 3. EMME05, "Ellsworth Ranch Bridge." Loveland, Colorado: FRASERdesign, produced for the Iowa Department of Transportation, 1993.

Nichols, Ira Alfred. Pioneer Days in Iowa Falls. Fort Dodge, Iowa: Messenger Printing Co., 1944.

Quivik, Fredric. "Montana's Minneapolis Bridge Builders." IA: The Journal of the Society of Industrial Archeology 10:1 (1984), 35-54.

"Rare King Bridge trusses found in S.D., Minn." SIA Newsletter 21:1 (Spring 1992), 3.

Sage, Leland L. A History of Iowa. Ames, Iowa: The Iowa State University Press, 1974.

Simmons, David A. "Bridge Building on a National Scale: The King Iron Bridge and Manufacturing Company." IA: The Journal for the Society for Industrial Archaeology, 15:2, (1989), 23-39.

ADDENDUM TO  
ELLSWORTH RANCH BRIDGE  
(Des Moines River Bridge)  
Iowa Historic Bridges Recording Project  
Spanning East Fork of Des Moines River at 130th Street  
Dolliver vic.  
Emmet County  
Iowa

HAER No. IA-52

HAER  
IOWA  
32-DOLL.V,  
1-

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD

National Park Service  
1849 C Street, NW  
Washington, DC 20240

ADDENDUM TO  
ELLSWORTH RANCH BRIDGE  
HAER No. IA-52  
(Page 10)

HISTORIC AMERICAN ENGINEERING RECORD

ELLSWORTH RANCH BRIDGE  
(Des Moines River Bridge)

HAER  
IOWA  
32 - DOLL. V,  
1 -

This appendix is an addendum to a 9-page report previously transmitted to the Library of Congress.

**APPENDIX: ADDITIONAL REFERENCES**

Interested readers may consult the Historical Overview of Iowa Bridges, HAER No. IA-88: "This historical overview of bridges in Iowa was prepared as part of Iowa Historic Bridges Recording Project - I and II, conducted during the summers of 1995 and 1996 by the Historic American Engineering Record (HAER). The purpose of the overview was to provide a unified historical context for the bridges involved in the recording projects."